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66. (Amended) The method according to claim 65, wherein said long chain polyunsaturated fatty acid is selected from the group consisting of [18:1 ω 9, LA, GLA, SDA and ALA] oleic acid, linolenic acid, gamma-linolenic acid, stearidonic acid and alpha-linolenic acid.

67. (Reiterated) A microbial oil or fraction thereof produced according to the method of claim 65.

68. (Reiterated) A method of treating or preventing malnutrition comprising administering said microbial oil of claim 67 to a patient in need of said treatment or prevention in an amount sufficient to effect said treatment or prevention.

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69. (Amended) A pharmaceutical composition comprising said microbial oil or fraction thereof of claim 67 and a pharmaceutically acceptable carrier.

70. (Reiterated) The pharmaceutical composition of claim 69, wherein said pharmaceutical composition is in the form of a solid or a liquid.

71. (Reiterated) The pharmaceutical composition of claim 70, wherein said pharmaceutical composition is in a capsule or tablet form.

72. (Reiterated) The pharmaceutical composition of claim 69 further comprising at least one nutrient selected from the group consisting of a vitamin, a mineral, a carbohydrate, a sugar, an amino acid, a free fatty acid, a phospholipid, an antioxidant, and a phenolic compound.

73. (Reiterated) A nutritional formula comprising said microbial oil or fraction thereof of claim 67.

74. (Reiterated) The nutritional formula of claim 73, wherein said nutritional formula is selected from the group consisting of an infant formula, a dietary supplement, and a dietary substitute.

75. (Reiterated) The nutritional formula of claim 74, wherein said infant formula, dietary supplement or dietary supplement is in the form of a liquid or a solid.

76. (Reiterated) An infant formula comprising said microbial oil or fraction thereof of claim 67.

77. (Reiterated) The infant formula of claim 76 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electrodialysed whey, electrodialysed skim milk, milk whey, soy protein, and other protein hydrolysates.

78. (Reiterated) The infant formula of claim 77 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

79. (Reiterated) A dietary supplement comprising said microbial oil or fraction thereof of claim 67.

80. (Reiterated) The dietary supplement of claim 79 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electrodialysed whey, electrodialysed skim milk, milk whey, soy protein, and other protein hydrolysates.

81. (Reiterated) The dietary supplement of claim 80 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

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82. (Amended) The dietary supplement of claim 79 [or claim 81,] wherein said dietary supplement is administered to a human or an animal.

83. (Reiterated) A dietary substitute comprising said microbial oil or fraction thereof of claim 67.

84. (Reiterated) The dietary substitute of claim 83 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electrodialysed whey, electrodialysed skim milk, milk whey, soy protein, and other protein hydrolysates.

85. (Reiterated) The dietary substitute of claim 84 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

86. (Amended) The dietary substitute of claim 83 [or claim 85,] wherein said dietary substitute is administered to a human or animal.

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87. (Amended) A method of treating a patient having a condition caused by insufficient intake or production of polyunsaturated fatty acids comprising administering to said patient [said dietary substitute of claim 83 or]

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said dietary supplement of claim 79 in an amount sufficient to effect said treatment.

88. (Amended) The method of claim 87, wherein [said dietary substitute or] said dietary supplement is administered enterally or parenterally.

89. (Reiterated) A cosmetic comprising said microbial oil or fraction thereof of claim 67.

90. (Reiterated) The cosmetic of claim 88, wherein said cosmetic is applied topically.

91. (Reiterated) The pharmaceutical composition of claim 69, wherein said pharmaceutical composition is administered to a human or an animal.

92. (Reiterated) An animal feed comprising said microbial oil or fraction thereof of claim 67.

93. (Amended) The method of claim [20] 65 wherein said microbial cells are [fungus is Mortierella species] fungus cells.

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94. (Amended) The method of claim 93 wherein said [fungus is] fungus cells are [Mortierella alpina] yeast cells.

95. (Amended) An isolated polypeptide wherein said polypeptide has a peptide sequence selected from the group consisting of SEQ ID NO:34 - SEQ ID NO:40.

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96. (Amended) An isolated polypeptide wherein said polypeptide has a peptide sequence selected from the group consisting of SEQ ID NO:20, SEQ ID NO:22, SEQ ID NO:25 and SEQ ID NO:26.

97. (Reiterated) A method for production of gamma-linolenic acid in a eukaryotic cell culture, said method comprising:

growing a eukaryotic cell culture having a plurality of recombinant eukaryotic cells, wherein said recombinant eukaryotic cells or ancestors of said recombinant eukaryotic cells were transformed with a vector comprising fungal DNA encoding a polypeptide which converts linoleic acid to gamma-linolenic acid, wherein said DNA is operably associated with an expression control sequence functional in said recombinant eukaryotic cells, under conditions whereby said DNA is expressed, whereby gamma-linolenic acid is produced from linoleic acid in said eukaryotic cell culture.

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98. (Amended) The method according to Claim 97 wherein said eukaryotic cells are selected from the group consisting of mammalian cells, [plant cells,] fungal cells, avian cells and algal cells.

Insert the following new claims:

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--99. A method for producing an oil or fraction thereof comprising growing one or more transgenic microbial cells under suitable conditions whereby said cells express a transgenic polypeptide wherein the sequence of said polypeptide comprises a sequence selected from the group consisting of residues 50-53, 39-43, 172-176, 204-213 and 390-402 of SEQ ID NO:2.

100. A microbial oil or fraction thereof produced according to the method of claim 99.

101. A method of treating or preventing malnutrition comprising administering said microbial oil of claim 100 to a patient in need of said treatment or prevention in an amount sufficient to effect said treatment or prevention.

102. A pharmaceutical composition comprising said microbial oil or fraction of claim 100 and a pharmaceutically acceptable carrier.

103. The pharmaceutical composition of claim 102, wherein said pharmaceutical composition is in the form of a solid or a liquid.

104. The pharmaceutical composition of claim 102, wherein said pharmaceutical composition is in a capsule or tablet form.

105. The pharmaceutical composition of claim 103 further comprising at least one nutrient selected from the group consisting of a vitamin, a mineral, a carbohydrate, a sugar, an amino acid, a free fatty acid, a phospholipid, an antioxidant, and a phenolic compound.

106. A nutritional formula comprising said microbial oil or fraction thereof of claim 100.

107. The nutritional formula of claim 106, wherein said nutritional formula is selected from the group consisting of an infant formula, a dietary supplement, and a dietary substitute.

108. The nutritional formula of claim 107, wherein said infant formula, dietary supplement or dietary supplement is in the form of a liquid or a solid.

109. An infant formula comprising said microbial oil or fraction thereof of claim 100.

110. The infant formula of claim 109 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electrodialysed whey, electrodialysed skim milk, milk whey, soy protein, and other protein hydrolysates.

111. The infant formula of claim 110 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

112. A dietary supplement comprising said microbial oil or fraction thereof of claim 100.

113. The dietary supplement of claim 112 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electrodialysed whey, electrodialysed skim milk, milk whey, soy protein, and other protein hydrolysates.

114. The dietary supplement of claim 113 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

115. The dietary supplement of claim 112 wherein said dietary supplement is administered to a human or an animal.

116. A dietary substitute comprising said microbial oil or fraction thereof of claim 100.

117. The dietary substitute of claim 116 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electrodialysed whey, electrodialysed skim milk, milk whey, soy protein, and other protein hydrolysates.

118. The dietary substitute of claim 117 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

119. The dietary substitute of claim 116 wherein said dietary substitute is administered to a human or animal.

120. A method of treating a patient having a condition caused by insufficient intake or production of polyunsaturated fatty acids comprising administering to said patient said dietary supplement of claim 112 in an amount sufficient to effect said treatment.

121. The method of claim 120, wherein said dietary supplement is administered enterally or parenterally.

122. A method of treating a patient having a condition caused by insufficient intake or production of polyunsaturated fatty acids comprising administering to said patient said dietary substitute of claim 116.

123. The method of claim 122, wherein said dietary substitute is administered enterally or parenterally

124. A cosmetic comprising said microbial oil or fraction thereof of claim 100.

125. The cosmetic of claim 124, wherein said cosmetic is applied topically.

126. The pharmaceutical composition of claim 102, wherein said pharmaceutical composition is administered to a human or an animal.

127. An animal feed comprising said microbial oil or fraction thereof of claim 100.

128. A method for producing an oil or fraction thereof comprising the steps of: growing microbial cells which contain one or more transgenes which encode a transgene expression product under conditions whereby said one or more transgenes are expressed, whereby long chain polyunsaturated fatty acid biosynthesis in said cells is altered whereby said transgene comprises a nucleotide sequence which encodes a polypeptide wherein the sequence of the polypeptide comprises a sequence selected from the group consisting of SEQ ID NO:4, SEQ ID NO:20, SEQ ID NO:22, SEQ ID NO:24 and SEQ ID NO:26.

129. A microbial oil or fraction thereof produced according to the method of claim 128.

130. A method of treating or preventing malnutrition comprising administering said microbial oil of claim 129 to a patient in need of said treatment or prevention in an amount sufficient to effect said treatment or prevention.

131. A pharmaceutical composition comprising said microbial oil or fraction of claim 129 and a pharmaceutically acceptable carrier.

132. The pharmaceutical composition of claim 131 wherein said pharmaceutical composition is in the form of a solid or a liquid.

133. The pharmaceutical composition of claim 131 wherein said pharmaceutical composition is in a capsule or tablet form.

134. The pharmaceutical composition of claim 133 further comprising at least one nutrient selected from the group consisting of a vitamin, a mineral, a carbohydrate, a sugar, an amino acid, a free fatty acid, a phospholipid, an antioxidant, and a phenolic compound.

135. A nutritional formula comprising said microbial oil or fraction thereof of claim 129.

136. The nutritional formula of claim 135 wherein said nutritional formula is selected from the group consisting of an infant formula, a dietary supplement, and a dietary substitute.

137. The nutritional formula of claim 136 wherein said infant formula, dietary supplement or dietary supplement is in the form of a liquid or a solid.

138. An infant formula comprising said microbial oil or fraction thereof of claim 129.

139. The infant formula of claim 138 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola

oil, mono- and diglycerides, glucose, edible lactose, electrolysed whey, electrolysed skim milk, milk whey, soy protein, and other protein hydrolysates.

140. The infant formula of claim 139 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

141. A dietary supplement comprising said microbial oil or fraction thereof of claim 129.

142. The dietary supplement of claim 141 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electrolysed whey, electrolysed skim milk, milk whey, soy protein, and other protein hydrolysates.

143. The dietary supplement of claim 142 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

144. The dietary supplement of claim 143 wherein said dietary supplement is administered to a human or an animal.

145. A dietary substitute comprising said microbial oil or fraction thereof of claim 129.

146. The dietary substitute of claim 145 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electro dialysed whey, electro dialysed skim milk, milk whey, soy protein, and other protein hydrolysates.

147. The dietary substitute of claim 146 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

148. The dietary substitute of claim 145 wherein said dietary substitute is administered to a human or animal.

149. A method of treating a patient having a condition caused by insufficient intake or production of polyunsaturated fatty acids comprising administering to said patients said dietary substitute of claim 148 in an amount sufficient to effect said treatment.

150. The method of claim 149 wherein said dietary substitute is administered enterally or parenterally.

151. A cosmetic comprising said microbial oil or fraction thereof of claim 129.

152. The cosmetic of claim 151 wherein said cosmetic is applied topically.

153. The pharmaceutical composition of claim 131 wherein said pharmaceutical composition is administered to a human or an animal.

154. An animal feed comprising said microbial oil or fraction thereof of claim 129.

155. A method for producing an oil or fraction thereof comprising growing one or more transgenic microbial cells under suitable conditions whereby said cells express one or more transgenic polypeptides wherein the sequence of said one or more polypeptides comprises a sequence selected from the group consisting of SEQ ID NO:4, SEQ ID NO:20, SEQ ID NO:22, SEQ ID NO:24 and SEQ ID NO:26.

156. A microbial oil or fraction thereof produced according to the method of claim 155.

157. A method of treating or preventing malnutrition comprising administering said microbial oil of claim 156 to a patient in need of said treatment or prevention in an amount sufficient to effect said treatment or prevention.

158. A pharmaceutical composition comprising said microbial oil or fraction of claim 156 and a pharmaceutically acceptable carrier.

159. The pharmaceutical composition of claim 158 wherein said pharmaceutical composition is in the form of a solid or a liquid.

160. The pharmaceutical composition of claim 158 wherein said pharmaceutical composition is in a capsule or tablet form.

161. The pharmaceutical composition of claim 158 further comprising at least one nutrient selected from the group consisting of a vitamin, a mineral,

a carbohydrate, a sugar, an amino acid, a free fatty acid, a phospholipid, an antioxidant, and a phenolic compound.

162. A nutritional formula comprising said microbial oil or fraction thereof of claim 156.

163. The nutritional formula of claim 162 wherein said nutritional formula is selected from the group consisting of an infant formula, a dietary supplement, and a dietary substitute.

164. The nutritional formula of claim 162 wherein said infant formula, dietary supplement or dietary supplement is in the form of a liquid or a solid.

165. An infant formula comprising said microbial oil or fraction thereof of claim 156.

166. The infant formula of claim 165 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electrodialysed whey, electrodialysed skim milk, milk whey, soy protein, and other protein hydrolysates.

167. The infant formula of claim 166 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

168. A dietary supplement comprising said microbial oil or fraction thereof of claim 156.

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169. The dietary supplement of claim 168 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electrodialysed whey, electrodialysed skim milk, milk whey, soy protein, and other protein hydrolysates.

170. The dietary supplement of claim 169 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

171. The dietary supplement of claim 170 wherein said dietary supplement is administered to a human or an animal.

172. A dietary substitute comprising said microbial oil or fraction thereof of claim 156.

173. The dietary substitute of claim 172 further comprising at least one macronutrient selected from the group consisting of coconut oil, soy oil, canola oil, mono- and diglycerides, glucose, edible lactose, electrodialysed whey, electrodialysed skim milk, milk whey, soy protein, and other protein hydrolysates.

174. The dietary substitute of claim 173 further comprising at least one vitamin selected from the group consisting of Vitamins A, C, D, E, and B complex; and at least one mineral selected from the group consisting of calcium, magnesium, zinc, manganese, sodium, potassium, phosphorus, copper, chloride, iodine, selenium, and iron.

175. The dietary substitute of claim 173 wherein said dietary substitute is administered to a human or animal.

176. A method of treating a patient having a condition caused by insufficient intake or production of polyunsaturated fatty acids comprising administering to said patient said dietary substitute of claim 172 in an amount sufficient to effect said treatment.

177. The method of claim 176 wherein said dietary substitute is administered enterally or parenterally.

178. A cosmetic comprising said microbial oil or fraction thereof of claim 156.

179. The cosmetic of claim 178 wherein said cosmetic is applied topically.

180. The pharmaceutical composition of claim 158 wherein said pharmaceutical composition is administered to a human or an animal.

181. An animal feed comprising said microbial oil or fraction thereof of claim 156.

182. An isolated nucleotide sequence comprising a nucleotide sequence selected from the group consisting of SEQ ID NO:19, SEQ ID NO:21, SEQ ID NO:23 and SEQ ID NO:25.

183. An isolated and purified polypeptide wherein said polypeptide comprises a sequence selected from the group consisting of SEQ ID NO:20, SEQ ID NO:22, SEQ ID NO:24 and SEQ ID NO:26.

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184. A method for producing an fatty acid comprising the steps of: growing microbial cells which contain one or more transgenes which encode a transgene expression product under conditions whereby said one or more transgenes are expressed, whereby long chain polyunsaturated fatty acid biosynthesis in said cells is altered whereby said transgene comprises a nucleotide sequence which encodes a polypeptide wherein the sequence of the polypeptide comprises a sequence selected from the group consisting of SEQ ID NO:4, SEQ ID NO:20, SEQ ID NO:22, SEQ ID NO:24 and SEQ ID NO:26.

185. A fatty acid produced according to the method of claim 184.

186. A fatty acid produced according to the method of claim 65.

187. A method for producing fatty acid comprising growing one or more transgenic microbial cells under suitable conditions whereby said cells express a transgenic polypeptide wherein the sequence of said polypeptide comprises a sequence selected from the group consisting of residues 50-53, 39-43, 172-176, 204-213 and 390-402 of SEQ ID NO:2

188. A fatty acid produced according to claim 187. --

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